WHAT IS CLAIMED IS:

1. A laser, comprising:

an OPS-structure having a gain-structure surmounting a mirror-structure, said gain-structure including a plurality of active layers having pump-light-absorbing layers therebetween, said active layers having a composition selected to provide emission of electromagnetic radiation at a predetermined fundamental-wavelength between about 425 nanometers and 1800 nanometers when optical-pump light is incident on said gain-structure, and said mirror-structure including a plurality of layers of alternating high and low refractive index and having an optical thickness of about one-quarter wavelength of said predetermined wavelength;

a laser-resonator formed between said mirror-structure of said OPS-structure and a reflector spaced apart therefrom, said laser resonator having a longitudinal axis;

an optical arrangement for delivering said pump-light to said gain-structure, thereby causing fundamental laser-radiation having said fundamental-wavelength to oscillate in said laser-resonator;

a heat-sink arrangement for cooling said OPS-structure;

an optically-nonlinear crystal located in said laser-resonator and arranged for frequency-doubling said fundamental laser-radiation thereby providing frequency-doubled radiation having a wavelength half of said fundamental-wavelength; and

said laser-resonator, said optically nonlinear-crystal, said OPS-structure, said heat-sink arrangement and said optical pump-light-delivering arrangement selected and arranged such that said resonator delivers said frequency-doubled radiation as output-radiation having a wavelength between about 212 nanometers and 900 nanometers at an output-power greater than about 100 milliwatts.

2. The laser of claim 1, wherein said optically nonlinear-crystal, said OPS-structure and said optical pump-light-delivering arrangement selected and arranged such that said resonator delivers said frequency-doubled radiation as output-radiation having an output-power greater than about 1 Watt.

3. The laser of claim 1 wherein said laser-resonator has an optical length of at least about 5 cm.

4. The laser of claim 1, wherein said frequency-doubled radiation is delivered in a single axial-mode.

5. The laser of claim 1 wherein, said active layers of said gain structure are selected from the group of semiconductor compounds consisting of $In_xGa_{1-x}As_yP_{1-y}$, $Al_xGa_{1-x}As_yP_{1-y}$, and $In_xGa_{1-x}N$ where $0.0 \leq x \leq 1.0$ and $0 \leq y \leq 1$.

6. The laser of claim 5 wherein, said active layers of said gain structure have a composition of

$In_xGa_{1-x}As$ where $0.0 < x < 1.0$ and x is selected such that said fundamental wavelength is between about 900 and 1050 nanometers, and said gain structure includes separator layers between said active layers, said separator layers having a composition $GaAs_yP_{1-y}$.

7. The laser of claim 6 wherein, said high refractive index layers of said mirror-structure have a composition GaAs and said low refractive index layers of said mirror-structure have a composition $AlAs_yP_{1-y}$ where $0.0 < y < 1.0$.

8. The laser of claim 5 wherein, said active layers of said gain structure have a composition of $In_xGa_{1-x}P$ where $0.0 < x < 1.0$ and x is selected such that said fundamental wavelength is between about 700 and 900 nanometers, and said gain structure includes separator layers between said active layers said separator layers having a composition $In_yGa_{1-y}As_zP_{1-z}$ where $0.0 < y < 1.0$ and $0.0 < z < 1.0$.

9. The laser of claim 8 wherein, said high refractive index layers of said mirror-structure have a composition $In_pAl_{1-p}P$, $0.0 < p < 1.0$, and said low refractive index layers of said mirror-structure have a composition $Al_qGa_{1-q}As$, where $0.0 < q < 1.0$.

10. The laser of claim 5 wherein, said active layers of said gain structure have a composition of $In_xAs_{1-x}P$ where $0.0 < x < 1.0$ and x is selected such that said fundamental wavelength is between about 700 and 900 nanometers, and said gain structure includes separator layers between said active layers said

separator layers having a composition $Al_yGa_{1-y}As$ where $0.0 < y < 1.0$.

11. The laser of claim 10, wherein said high refractive index layers and said low refractive index layers of said mirror-structure are layers of respectively high and low refractive dielectric materials transparent to said fundamental wavelength.

12. The laser of claim 11, wherein said high refractive index material is zinc selenide and said low refractive index material is aluminum oxide.

13. The a laser of claim 1, wherein said active layers of said gain-structure have a gain-bandwidth, said optically nonlinear crystal has a spectral acceptance-range for frequency-doubling, said spectral-acceptance range being less than said gain bandwidth, and said laser resonator further includes a wavelength-selective element configured and arranged to prevent fundamental laser-radiation having a wavelength outside of said spectral-acceptance range from oscillating in said laser resonator.

14. The laser of claim 13, wherein said wavelength-selective element is a birefringent filter.

15. The laser of claim 13, wherein said wavelength-selective element is an etalon.

16. The laser of claim 1, wherein said heat-sink arrangement includes an actively-cooled member

and said actively-cooled member has a diamond layer in thermal contact therewith, said mirror-structure of said OPS-structure OPS structure being in thermal contact with said diamond layer.

17. The laser of claim 16, wherein said actively-cooled member is a microchannel-cooler.

18. The laser of claim 1 wherein said optical arrangement for delivering said pump-light to said gain-structure includes at least one optical-lightguide for transporting pump-light from a source thereof to an optical-focusing arrangement for focusing said pump-light, said optical-focusing including at least one lens.

19. The laser of claim 18 wherein said at least one lens is a radial-gradient-index lens.

20. The laser of claim 19 wherein said optical-focusing arrangement includes two radial-gradient-index lenses.

21. The laser of claim 1 wherein said optically-nonlinear-crystal is one of an LBO crystal and a CLBO crystal.

22. The laser of claim 1 wherein said optically-nonlinear crystal is a crystal of a material selected from the group of optically-nonlinear materials consisting of LBO, CLBO, BBO, SBBO, SBO, and BZBO.

23. The laser of claim 1 wherein said longitudinal-axis of said laser-resonator is folded at an angle by a fold-mirror located between said reflector and said OPS-structure, and said optically-nonlinear crystal is located on said longitudinal-axis of said laser-resonator between said reflector and said fold-mirror.

24. The laser of claim 23 wherein said fold-mirror is highly reflective for said fundamental-radiation and highly transmissive for said frequency-doubled radiation, said fold-mirror thereby serving as an output-coupling mirror for delivering said frequency-doubled output-radiation from said laser-resonator and essentially preventing frequency-doubled radiation from reaching said OPS-structure.

25. The laser of claim 24 wherein said fold mirror is convex for focusing the light into the optically-nonlinear crystal.

26. The laser of claim 1 wherein said OPS-structure is configured to minimize parasitic lateral oscillation of fundamental radiation therein.

27. The laser of claim 26, wherein said OPS-structure is in the form of a rectangular chip having an emitting-face, said pump-light being delivered onto said emitting-face in a predetermined area thereon, said chip having two pairs of parallel end-faces at right angles to said emitting-face, said parallel end faces being spaced apart by a distance at least three times the longest dimension of said predetermined pump-light-delivery area to minimize

parasitic lateral oscillation of fundamental radiation therein.

28. The laser of claim 26, wherein said OPS-structure is in the form of a rectangular chip having an emitting-face and having two pairs of parallel end-faces at right angles to said emitting-face, said parallel end-faces being roughened to prevent spectral reflection of fundamental radiation therefrom, thereby minimizing said parasitic lateral oscillation.

29. The laser of claim 1, wherein, in said mirror-structure, the refractive index, thermal conductivity, and number of said layers thereof are selected to provide maximum thermal conductivity of heat-generated in said gain-structure to said heat-sink arrangement, while providing sufficient reflectivity to cause build-up of fundamental radiation in said laser resonator.

30. The laser of claim 1, wherein said mirror-structure further includes a layer of a highly-reflective metal, said metal-layer being closest to said heat-sink arrangement.

31. The laser of claim 1, wherein said pump-light is delivered on said gain-structure of said OPS-structure in a predetermined pump spot-size and said resonator is configured such that the spot-size at said gain structure of said oscillating fundamental laser-radiation is about equal to said pump spot-size.

32. The laser of claim 31, said frequency-doubled output radiation is delivered in a single axial-mode.

33. A laser, comprising:

an OPS-structure having a gain-structure surmounting a mirror-structure, said gain-structure including a plurality of active layers having pump-light-absorbing layers therebetween, said active layers having a composition selected to provide emission of electromagnetic radiation at a predetermined fundamental-wavelength between about 425 nanometers and 1800 nanometers when optical-pump light is incident on said gain-structure, and said mirror-structure including a plurality of layers of alternating high and low refractive index and having an optical thickness of about one-quarter wavelength of said predetermined wavelength;

a laser-resonator formed between said mirror-structure of said OPS-structure and a reflector spaced apart therefrom, said laser resonator having a longitudinal axis;

an optical arrangement for delivering said pump-light to said gain-structure, thereby causing fundamental laser-radiation having said fundamental-wavelength to oscillate in said laser-resonator;

a heat-sink arrangement for cooling said first OPS-structure;

a first optically-nonlinear crystal located in said laser-resonator and arranged for frequency-doubling said fundamental laser-radiation, thereby providing frequency-doubled

radiation having a wavelength half of said fundamental wavelength;

a second optically-nonlinear crystal located in said laser-resonator an arranged for mixing said frequency-doubled radiation and said fundamental laser-radiation thereby providing frequency-tripled radiation having a wavelength one-third of said fundamental-wavelength; and

said laser-resonator, said optically nonlinear-crystal, said OPS-structure, said heat-sink arrangement and said optical pump-light-delivering arrangement selected and arranged such that said resonator delivers said frequency-tripled radiation as output-radiation having a wavelength between about 142 nanometers and 600 nanometers at an output-power greater than about 100 milliwatts.

34. The laser of claim 33 wherein said longitudinal-axis of said laser-resonator if folded at an angle by a fold-mirror located between said reflector and said OPS-structure, and said first and second optically-nonlinear crystals are located on said longitudinal-axis of said laser-resonator between said reflector and said fold-mirror.

35. The laser of claim 32 wherein said fold-mirror is highly reflective for said fundamental-radiation and highly transmissive for said frequency-doubled radiation and said frequency-tripled radiation, said fold mirror thereby serving as an output-coupling mirror for delivering said frequency-tripled output-radiation from said laser-resonator and essentially preventing frequency-doubled and

frequency tripled radiation from reaching said OPS-structure.

36. The laser of claim 33, wherein said first optically-nonlinear crystal is a crystal of a material selected from the group of optically-nonlinear materials consisting of LBO, and CLBO.

37. The laser of claim 33 wherein said second optically-nonlinear crystal is a crystal of a material selected from the group of optically-nonlinear materials consisting of LBO, CLBO, BBO, SBBO, SBO, and BZBO.

38. A laser, comprising:

a laser-resonator having a resonator axis and being terminated by first and second mirrors;

an OPS-structure having a surface-emitting gain-structure, said gain-structure including a plurality of active layers having separator layers therebetween said active layers having a composition selected to provide emission of electromagnetic radiation at a predetermined fundamental-wavelength when optical-pump light is incident on said gain-structure, and said laser-resonator being configured to include said gain-structure of said OPS-structure;

an optical arrangement for delivering said pump-light to said gain-structure, thereby causing fundamental laser-radiation having said fundamental-wavelength to oscillate in said laser-resonator;

a heat-sink arrangement for cooling said OPS-structure;

an optically-nonlinear crystal located in said laser-resonator and arranged for frequency-doubling said fundamental laser-radiation thereby providing frequency-doubled radiation having a wavelength half of said fundamental-wavelength; and

said laser-resonator, said optically nonlinear crystal, said heat-sink arrangement and said optical pump-light-delivering arrangement selected and arranged such that said resonator delivers said frequency-doubled radiation as output-radiation at an output-power greater than about 100 milliwatts.

39. A laser as recited in claim 38 wherein said OPS structure surmounts a mirror structure, and wherein said mirror structure functions as a fold mirror in the laser resonator.

40. A laser, comprising:

an OPS-structure having a gain-structure surmounting a mirror-structure, said gain-structure including a plurality of active layers having pump-light-absorbing layers therebetween, said active layers having a composition selected to provide emission of electromagnetic radiation at a predetermined fundamental-wavelength when optical-pump light is incident on said gain-structure, and said mirror-structure including a plurality of layers of alternating high and low refractive index and having an optical thickness of about one-quarter wavelength of said predetermined wavelength;

a laser-resonator formed between said mirror-structure of said OPS-structure and a reflector spaced apart therefrom, said laser resonator having a longitudinal axis, said longitudinal axis being folded by a fold-mirror located thereon between said OPS-structure and said reflector;

an optical arrangement for delivering said pump-light to said gain-structure, thereby causing fundamental laser-radiation having said fundamental-wavelength to oscillate in said laser-resonator; and

a first optically-nonlinear crystal located in said laser-resonator between said fold-mirror and said reflector said fold-mirror being configured to focus said oscillating fundamental radiation into said optically-nonlinear crystal, said optically-nonlinear crystal being arranged for frequency-doubling said fundamental laser-radiation thereby generating frequency-doubled

radiation having a wavelength half of said fundamental-wavelength.

41. The laser of claim 40, further including a heat-sink arrangement for cooling said OPS-structure, and wherein said laser-resonator, said optically nonlinear-crystal, said OPS-structure, said heat-sink arrangement and said optical pump-light-delivering arrangement selected and arranged such that said resonator delivers said frequency-doubled radiation as output-radiation at an output-power greater than about 100 milliwatts.

42. The laser of claim 40, wherein said fold-mirror is highly reflective for said fundamental laser-radiation and highly transmissive for said frequency-doubled radiation, whereby said frequency-doubled radiation exits said resonator as output radiation.

43. The laser of claim 40, wherein said composition of said active layers of said gain-structure is selected such that said fundamental-wavelength is between about 425 nm and 1800 nm, said frequency-doubled radiation correspondingly having a wavelength between about 212 and 900 nm.

44. The laser of claim 40, further including a second optically-nonlinear crystal located in said laser-resonator an arranged for mixing said frequency-doubled radiation and said fundamental laser-radiation thereby providing frequency-tripled radiation having a wavelength one-third of said fundamental-wavelength.